



State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

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March 6, 1995

R. E. Dunne
Project Manager
Kennecott Utah Copper
P.O. Box 352
Bingham Canyon, Utah 84006-0352

Post-It™ brand fax transmittal memo 7671		# of pages ▶ 14
To Paula Dougherty	From Wayne Hedberg	
Co. Kennecott	Co. DOGM	
Dept.	Phone # 538-5340	
Fax # 252-2826	Fax # 359-3940	

Dear Mr. Dunne:

Re: Review of Notice of Intention to Commence Large Mining Operations ("NOI"), Kennecott Utah Copper, Tailing Modernization Project/North Impoundment (North Impoundment), M/035/015, Salt Lake County, Utah

The Division has completed a review of your NOI for the North Impoundment project received September 16, 1994. After reviewing the information, the Division has the following comments which will need to be addressed before tentative approval may be granted. The comments are listed below under the applicable Minerals Rule heading. Relevant pages of the NOI submission are also referenced. Please format your response in a similar fashion.

R647-4-104 Operator's, Surface and Mineral Ownership

Kennecott states on page 1 & 2 of the LMO application form (R647-4-104), that all of the project area surface and minerals rights are owned by Kennecott Utah Copper Corporation. Please modify the surface and mineral ownership drawing (i.e., Base & Property Map - figure 1) to clearly show the outer boundaries of Kennecott's surface and mineral ownership and the surface and mineral ownership of those lands adjacent to the project expansion. This information is requested so that the Division may provide appropriate notice to adjacent landowners of the project area of our eventual tentative decision on the permit application. (DWH)

R647-4-105 Maps, Drawings & Photographs

105.2 Surface facilities map

Attachment A, page 9 - Areas of salt excavation will be backfilled with approximately three feet of compacted clay to ensure continuity of the impervious subgrade. Please show the location(s) of the borrow area(s) on the appropriate drawings. What specification, if any, will the clay be compacted to? (AAG)

Attachment A, page 10 - Support facilities for fuel, oil, and lubricants are planned near the northeast corner of the North Impoundment. Please show the area(s) being considered for these facilities on the appropriate drawing(s) and provide a more detailed description of the size, type and number of facilities proposed. Include proposed contingency plans for containment and/or cleanup of any accidental spills. (AAG)

105.3 Drawings or Cross Sections (slopes, roads, pads, etc.)

Page 8, MR-LMO. Please provide a description of the sediment pond design along with cross sectional drawings. Also see comments under section 106.9 below. (AAG)

Attachment A, page 5. Please show the North Expansion berm (new stabilization berm) on the appropriate drawings if practical. (AAG)

Please provide a reclamation treatments map which identifies those areas described by the line items listed under the Surety Section (pages 17-18) of the submission. The acreages on the map should agree with the acreages used in the surety estimate calculations. (AAG)

R647-4-106 Operation Plan

106.2 Type of operations conducted, mining method, processing etc.

Attachment A, pages 6 & 11 - The North Impoundment embankment will have a *drainage blanket* of crushed smelter slag placed beneath it to promote proper drainage within the embankment. There is also plan reference to slag dikes within the impoundment and possible use of the material as road base. What is its chemical composition and what residual elements are tied up in the slag matrix? Has this material been chemically analyzed and tested in a crushed state to determine its leachability/reactivity under a worse case acidic tailings leachate condition? Has any testing been performed on the interaction of the slag with the tailings material? If so, please describe the outcome of this testing. If not, please explain. Have TCLP, SWA 846 Method 1312 (Synthetic Precipitation Leaching Procedure) or other appropriate analyses been performed to confirm the stability of this material once it is crushed? (Reference is made on page 3-88 of the preliminary draft EIS that the slag materials have been tested. Please provide copies of the analytical tests performed, the methods utilized, the number, source and location of samples taken, and the analytical results.)

Figure 4 - Drawing # 4710-72-030, shows an exploded cross-sectional view of the drainage blanket. The blanket is to be constructed of 4 separate overlapping layers totaling 38" in thickness. Which of these layers will be comprised of the crushed slag material? (DWH/AAG)

Attachment A, page 9. Salt deposits under the footprint of the embankment will be removed to permit foundation preparation. Where will these salt deposits be removed to? What is the projected volume of salt deposits to be removed? (AAG)

FORM MR-LMO, page 5, Operation Plan, item 13 - The application references chemical testing of the mobility of metals from Kennecott's existing tailings impoundment and indicates that there are no health risks or environmental problems associated with the tailings. Extrapolated projections are made as applicable to the North Impoundment tailings. Acidification potential for the tailings materials and the neutralization potential of the underlying sediments are also discussed. Please provide copies of all pertinent laboratory analytical data used in reaching these conclusions. Include the number of samples evaluated, sample locations, sample depths, range of test values, etc. Please quantify the terms used in this submission "marginally acidic to neutral". Please provide the analytical results of the static tests and long term kinetic testing as well. *When responding to this information request, please refer to the attached analytical procedures/testing guidance document, for characterizing the tailings and slag materials.* (DWH?AAG)

Please describe the chemical testing used to characterize the carbonate-rich sediments and provide copies of the test results. Please include calculations showing neutralization potential of the sediments and describe any assumptions made. Please provide data to support the claim that the subsurface conditions for the North Impoundment are essentially the same as the existing Tailings Impoundment. What sampling was performed to reach this conclusion? (AAG)

106.4 Nature of materials mined, waste & estimated tonnages

What is the estimated annual amount of tailings to be placed in the North Impoundment? (AAG)

What is the permit status of the proposed solid waste landfill within the North Impoundment? Has this facility been permitted with the Division of Solid and Hazardous Waste? What materials will be placed in this landfill? (AAG)

106.6 Plan for protecting & redepositing soils

Please see the variance section R647-4-112 below. (LMK)

Page 14, MR-LMO. Soils salvaged from the project area will be placed in the visual buffer corridor or in the restoration of other areas disturbed during construction. Division Rules generally require that all topsoil salvaged from areas disturbed by mining practices be used in reclamation of the mine's disturbed area(s). Only a limited soil volume is suitable for salvage (enough for reclaiming roughly 2% of the expansion area). Since ongoing revegetation testplots on the current tailings pond have demonstrated success in reestablishing vegetation without topsoil, the Division concurs that the best use for the limited amount of salvaged topsoil is to enhance vegetation establishment of the visual corridor. (AAG/LMK)

106.8 Depth to groundwater, extent of overburden, geology

Page 8, MR-LMO. What are the depths (maximum and minimum) for the shallow unconfined and deeper confined aquifers below the North Impoundment site? How extensive are each of these aquifers? Please provide any available water level maps that reflect the shallow and principle aquifers in this area. (AAG/DWH)

106.9 Proposed location and size water storage/treatment ponds.

FORM MR-LMO, page 6, Operation Plan, item 15 - The application refers the reviewer to Figures 3 & 4 for design drawings and typical cross-sections of major drainage control structures. The general locations are shown for most of the structures referenced in the text, with the exception of the *collection pond* (for toe drain seepage) as described in Attachment A, page 10. Please provide a detailed typical cross-section of the collection pond and the new C-7 ditch. Please provide copies of the basic engineering and hydrologic design criteria used for sizing the collection pond, the new C-7 ditch and the toe ditch.

Attachment A, page 9. A new *sedimentation pond* will be constructed to clarify construction water and handle reclaimed process water. A system to add alum or other flocculation agents will be installed upstream of the pond to enhance clarification and reduce suspended solids. Appropriate design details/drawings with sizing criteria/assumptions for the new sediment pond are requested. What is the proposed sediment maintenance (clean out) program for the settling pond and the extended clarification canal? (DWH)

Attachment A, page 10. A new collection pond will be constructed to collect seepage from the toe ditch prior to pumping it back to the decant pond in the North Impoundment. Where will this pond be located? Please show its location on the appropriate design drawings (eg., Drawing # 4710-72-030, Site Plan & Sections - figure 4). Appropriate design drawing details showing design specifications and sizing criteria for this collection pond are also requested. (DWH)

Attachment A, page 10 - The toe dike will be constructed of excavated clay from the toe ditch, granular material from the salt evaporator dikes and existing Kennecott borrow sources. Please describe these existing borrow sources for clay and show these sources on the appropriate drawing. What are Kennecott's plans for reclamation of these existing borrow areas? (AAG)

Attachment A, page 11 - The existing gypsum tailings in the southwest corner of the North Impoundment will be buried by impoundment operations. What is the estimated volume of gypsum to be buried? Is this volume significant enough to impact the volume of tailings storage needed? Presumably this loss in overall storage volume has been accounted for in the revised/reconfigured impoundment designs. (AAG)

Given our understanding of an inherent relatively low pH water chemistry of the phosphogyp-stack, will the gypsum (or any resultant leachate created) have a significant chemical reaction with the tailings material? It is our understanding that the phosphogyp-stack also contains elevated radionuclides values (radium & uranium). What is the status of the ongoing assessment of the stack for these elements and when will the report information be available for evaluation by the regulatory authorities? (AAG/DWH)

Attachment A, page 15 - Embankment construction methods and operational dust control to be used during Phase 2 operations may differ from Phase 1 methods. The Division will need to be informed of any changes in the construction method prior to initiating those changes. (AAG)

R647-4-107 Operation Practices

107.5 Suitable soils removed & stored

Please see the variance section R647-4-112 below. (LMK)

R647-4-109 Impact Assessment

109.1 Impacts to surface & groundwater systems

FORM MR-LMO, page 8, Surface Water - Kennecott describes the UPDES permitted outfalls under this section. "Outfall 007 will discharge water from the blanket drain toe collection ditch to Lee Creek just south of Interstate 80." Page 10, Attachment A, indicates that seepage from the drain toe collection ditch will be collected in a new containment pond prior to pumping back into the internal North Impoundment decant pond. These two descriptions for the toe drain seepage are somewhat contradictory and confusing. Assuming both are applicable, please clarify the UPDES permit conditions under which toe drain ditch seepage will/can be discharged to Lee Creek. (DWH)

What is the anticipated increase in discharge to historic Lee Creek channel? Will the existing channel capacity handle the increased flows without causing significant flooding/erosional problems or loss of wildlife habitat? (LMK/DWH)

FORM MR-LMO, page 8, Groundwater - Kennecott provides a brief description of the groundwater conditions in the general vicinity of the project area and anticipates that there will be very low potential for the existing Tailings Impoundment or North Impoundment water to discharge into the underlying shallow aquifer. What is the technical basis for this determination? (DWH)

What are the assessed/anticipated impacts to the local groundwater system from the burial of the phosphogyp-stack under the saturated tailings? What are the anticipated impacts to the local hydrology from the use of the crushed slag materials in the blanket underdrain and other

proposed locations? Please provide appropriate justification to support your projections. (DWH)

109.4 Slope stability, erosion control, air quality, safety

What is the current seismic stability rating of the existing tailings impoundment? What is the projected seismic stability of the proposed North Impoundment and the reinforced existing impoundment? Please describe the main design/construction differences between the two impoundments influencing stability? (AAG)

109.5 Actions to mitigate any impacts

The proposed expansion will impact approximately 582 acres of jurisdictional wetlands. Please reference the mitigation plans that are approved by the Army Corp of Engineers as part of the 404 permit in your submission to the Division. (LMK)

R647-4-110 Reclamation Plan

110.2 Roads, highwall, slopes, drainages, pits, etc. reclaimed

Page 15, MR-LMO - The reclamation program for Area X will include the removal of all unneeded tailings management facilities. Page 15, MR-LMO - A cross section of the site after completion of reclamation is shown on Figure 4 - Site Plan and Sections. Figure 4 appears to show the configuration of the North Expansion during operations rather than after final reclamation. What will be the configuration of the toe ditch and toe dike after final reclamation? Will these features be regraded or remain in place? We understand that the Division of Water Quality may want the toe ditches to remain permanently to collect seepage after operations have ceased. The final reclamation plan should clearly describe the ultimate disposition of these ditches upon mine closure. (AAG)

Page 17, MR-LMO, Section VII, Surety - a line item estimate of \$80,000 is presented for "*slag surfacing of top of reclaim dikes*". No mention of this reclamation practice is noted in the review of the detailed description of the reclamation proposal. Please explain this slag surfacing proposal and include it as part of the reclamation plan if pertinent. (DWH)

110.5 Reclamation planting program

Page 14, MR-LMO - Reclamation of the exterior embankment raises during operations will involve spraying the new slope with a solution of water and chemical dust suppressant. What is the dust suppressant to be used? Has this suppressant been used on the existing impoundment? What effects, if any, does this suppressant have on the "soil chemistry" of the tailings material as a planting medium? (AAG)

R647-4-111 Reclamation Practices

111.12 Topsoil redistribution

Please refer to the variance section R647-4-112 below. (LMK)

R647-4-112 Variance

Three variances have been requested by Kennecott. Variances from Rules R647-4-107.5 and R647-4-111.12 (soil salvage and soil redistribution) have been requested. A majority of the existing soil resources within the North Expansion footprint were never salvaged by Morton Salt and now lie buried and contaminated beneath a saturated layer of evaporated salts. Kennecott proposes to utilize the limited suitable salvageable soils from within the footprint of the North Expansion area to enhance the revegetation efforts of the visual buffer zone/corridor. Because of the limited amount of salvageable soils, and Kennecott's demonstrated success in reestablishing vegetation on the tailings impoundment without topsoil, the Division concurs with Kennecott's proposed use of the salvageable soils. The variances from soil salvage and soil redistribution for the North Expansion area are hereby granted. (AAG/LMK)

The Division cannot grant a variance from Rule R647-4-111.13.11. Kennecott's justification for this variance is that no viable method exists to determine pre-mining vegetative cover, since most of the area has already been disturbed by other (non-mining) activities. While the Division agrees with this statement, a reasonable revegetation standard must be agreed upon by Kennecott and DOGM prior to approval of this NOI. Kennecott has constructed several test plots and has successfully revegetated the exterior side slopes of the existing tailings impoundment. Using data obtained from the test plots and revegetated impoundment slopes, reasonable revegetation standards should not be difficult to develop. In fact, it may be possible to use some areas that have been successfully reclaimed as reference areas (the reclamation standard would be 70% of the cover on these areas). The selection of the reference areas will need to be coordinated and approved by the Division. (LMK)

R647-4-113 Surety

Please provide additional information to support each line item shown in the surety estimate. This information would include a brief description of the particular task, volumes, areas, distances, or linear feet, unit costs, assumptions made, etc. For example, for line item "Construction of the reclaim dikes" you would briefly describe the construction method, provide linear feet of dike, CY per LF of dike, haul distances, equipment used, equipment productivity, and unit cost. This information is needed to verify the proposed surety estimate. The reclamation treatments map should support the areas, linear feet, etc., used in the calculation of the reclamation estimate. Please explain any acreages, linear feet, etc., used in the reclamation estimate which are not directly evident from examining the reclamation

Page 8
R. E. Dunne
M/035/015
March 6, 1995

treatments map (see comment section R647-4-105). An example of a reclamation estimate calculation is enclosed to assist you.

Division reclamation surety estimates must be based on third party costs. For this reason, the surety estimate will need to include: a mobilization cost of approximately \$1,000 per piece of large equipment to be used in performing the work; a supervision cost of 5% of the subtotal; a contingency of 10% of the subtotal (after supervision is added in). This total in present dollars (1995) is then escalated for five years into the future. The current escalation factor used by the Division is 2.01%. Please add these items into the reclamation surety estimate.

After the final amount of reclamation surety is calculated and agreed upon, the Division will need to know the form of surety Kennecott wishes to post. The Division will then provide the appropriate surety forms and a Reclamation Contract to be completed by Kennecott.

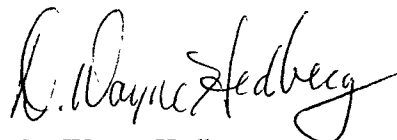
GENERAL COMMENTS:

Existing Tailings Pond Reclamation Summary

Appendix 4 summarizes much of the revegetation practices occurring on the existing tailings impoundment. However, additional detail needs to be included (or referenced). It is *assumed* that the same grass, forb, tree and shrub seed mixes, seeding/planting methods and timing as proposed for the north expansion, will also be used on the existing impoundment. This needs to be clearly stated/described under the reclamation plan for the existing impoundment. The proposed methods and plant materials are acceptable to the Division. Figures 7, 9 and 10 show sequencing of three areas (cells) for reclamation. No dates (years) are shown for the last two cells (which comprise most of the eastern one-half of the existing impoundment). The approximate dates (years) need to be identified when revegetation will begin on these areas. (LMK)

Thank you for your cooperation and assistance in completing this permitting action. If you have any questions regarding this letter please contact me, Tony Gallegos, or Lynn Kunzler of the Minerals Staff.

Sincerely,



D. Wayne Hedberg
Permit Supervisor
Minerals Regulatory Program

jb
Attachments (sample reclamation estimate, tailings analyses guideline)
cc: John Whitehead, DEQ
Mike Schwinn, ACOE
Lowell Braxton, DOGM
KENNTAIL..RVW

SURETY ESTIMATE EXAMPLE

SOURCES (USA), INC.
NE

45 / 017: RECLAMATION COST ESTIMATE

ENVIRONMENTAL / OCCUPATIONAL HEALTH

REFERENCE MAP: Surety Bond Reference
Rev. 4, 2/90 dpb

EMI No.	ACTIVITY	AREA TYPE	UNIT (ACRES)	EQUIPMENT (# OF UNITS)	WORK HRS. PER ACRE	TOTAL HOURS	COST CALCULATIONS	\$ / HOUR w/OPERATOR	TOTAL \$ / AREA	NOTES / COMMENTS
1	SALVAGE / CLEAN-UP	ALL STRUCTURE (EXCEPT BELOW GROUND)	26	Loaders (2) Trucks (2) Cranes (2)	N/A	N/A	N/A	N/A	60000	Salvage value to offset cost of demolition.
2	GRADING & SHAPING	FACILITY AREA	26	CAT D8L Dozer	12	312	312 / 176hr/mth = 1.8 mth Equip: 1.8 mth @ \$10805/mth = \$19449 Oper: 312 hr @ \$28.50/hr = \$8892 Labor: 312 hr @ \$29.20/hr = \$9110	120	37451	Rental Rate Blue Book page 9-104 Means pg. IX, crewB-10m
		ROADS (EXCEPT PAVED ACCESS)	3.4 miles	CAT D8L Dozer	0.17 miles/hr	20	20.0 / 176hr/mth = 0.11mth Equip: 0.11mth @ \$10805/mth = \$1189 Oper: 20.0 hr @ \$28.50/hr = \$570 Labor: 20.0 hr @ \$29.20/h = \$584	117	2343	Rental Rate Blue Book page 9-104 Means pg. IX, crewB-10m (100 ft width shaping)
		TOPSOIL STOCKPILE SITES	20.32	CAT D8L Dozer	6	122	122 / 176hr/mth = 0.7mth Equip: 0.7mth @ \$10805/mth = \$7564 Oper: 122hr @ \$28.50/hr = \$3477 Labor: 122 hr @ \$29.20/h = \$3563	120	14604	Rental Rate Blue Book page 9-104 Means pg. IX, crewB-10m
		GENERAL AREAS (@ 50%)	382.6	CAT D8L Dozer	12	4591	4591hrs/176hr/mt=26.1mth Equip: 26.1mth @ \$10805/mt = \$263219 Oper: 4591hr @ \$28.50/hr = \$130844 Labor: 4591hr @ \$29.20/h = \$134058	119	528121	50% Of All General Areas Rental Rate Blue Book page 9-104 Means pg. IX, crewB-10m
		CRESTS OF DUMP TOPS & DUMP LEACH TOPS	104.4	CAT D8L Dozer	13	1357.2	100 ft width * 45440 ln.ft = 4544000 sq ft 4544000sft/43560sft/acre = 104.4 acres 104.4 acre * 13hr/acre = 1357.2 hrs 1357.2hrs / 176hrs/mth = 7.7 mths Equip: 7.7mth @ \$10805/mth = \$83199 Oper: 1357.2hr @ \$28.50/ = \$38681 Labor: 1357.2hr @ \$29.20/ = \$39631	119	161511	Rental Rate Blue Book page 9-104 Means pg. IX, crewB-10m
		ROADS (EXCEPT PAVED ACCESS)	3.4 miles	CAT 229 Excavator	32 hours per mile	108.8	108.8hr/176hr/mt=0.62mth Equip: 0.62mth @ \$7895/mth = \$4895 Oper: 108.8hrs @ \$18.15/hr = \$1975 Labor: 108.8hr @ \$29.20/ = \$3177	93	10047	(100 ft width nominal) Rental Rate Blue Book page 10-16 Means pg. IX (bank shaping, culvert removal)

SURETY ESTIMATE EXAMPLE

ENVIRONMENTAL / OCCUPATIONAL HEALTH

REFERENCE MAP: Surety Bond Reference
Rev. 4, 2/90 dpb

RESOURCES (USA), INC.

045 / 017: RECLAMATION COST ESTIMATE

ITEM No.	ACTIVITY	AREA TYPE	UNIT (ACRES)	EQUIPMENT (# OF UNITS)	WORK HRS. PER ACRE	TOTAL HOURS	COST CALCULATIONS	\$ / HOUR w/OPERATOR	TOTAL \$ / AREA	NOTES / COMMENTS
3	ROAD RIPPING	ROADS (EXCEPT PAVED ACCESS)	3.4 miles	CAT D8L Dozer with ripper	0.17 miles/hr	20	20 hrs/176hrs/mt=0.11mth Equip: 0.11mth@ \$10805/mt = \$1189 Oper: 20.0hr @ \$28.50/hr = \$570 Labor: 20.0hr @ \$29.20/hr = \$584 Ripper: Equip: 20.0hr @ \$29.20/hr = \$584 Oper: 20.0hr @ \$2.30/hr = \$46	149	2973	(100 ft width nominal) Rental Rate Blue Book page 9-104 Means pg. IX Rental Rate Blue Book page 9-125
4	CLAY CAP PLACEMENT	DUMP LEACH TOPS	60.2	CAT 627E Scraper C.H.-P.P. 120 cu. yd.	30.2	1821	60.2acres*1.5ft=90.3A.F. 90.3A.F.*1613.4cuyd/A.F. = 145690cu.yd. 145690cuyd / 80cuyd/hr = 1821 hours 1821hr / 176hr/mth = 10.3 mth Equip: 10.3mth@ \$14160/mt = \$145848 Oper: 1821hr @ \$43.20/hr = \$78668 Labor: 1821hr @ \$29.20/hr = \$53174	153	277690	Rental Rate Blue Book page 9-93 Means pg. IX
5	SUB-SOIL PLACEMENT	DUMP LEACH TOPS	60.2	CAT 627E Scraper C.H.-P.P. 120 cu. yd.	60.4	3642	60.2acres*3.0ft=180.6A.F. 180.6A.F.*1613.4cuyd/A.F. = 291380cu.yd. 291380cuyd / 80cuyd/hr = 3642 hours 3642hr / 176hr/mth = 20.7 mth Equip: 20.7mth@ \$14160/mt = \$293112 Oper: 3642hr @ \$43.20/hr = \$157335 Labor: 3642hr @ \$29.20/hr = \$106347	153	556794	Rental Rate Blue Book page 9-93 Means pg. IX
6	LEVEL AREA SCARIFY BEFORE TOPSOIL	FACILITY, DUMP TOPS, LEACH TOPS, TAILINGS POND, 150% GEN. AREA, ROADS.	1789.8	CAT 16G Grader with 3 shank rear mount ripper / scarifier	0.33	260.7	260.7hr/176hr/mt=1.49mth Equip: 1.49mth@ \$10285/mt = \$15325 Oper: 260.7hr @ \$27.15/hr = \$7078 Labor: 260.7hr @ \$29.20/hr = \$7613 Ripper: Equip: 1.49mth @ \$925/mth = \$1379 Oper: 260.7hr @ \$1.35/hr = \$352	122	31747	Rental Rate Blue Book page 9-5 Means pg. IX Rental Rate Blue Book page 9-14

5 / 017: RECLAMATION COST ESTIMATE

NO.	ACTIVITY	AREA TYPE	UNIT ACRES	EQUIPMENT (# OF UNITS)	WORK HRS. PER ACRE	TOTAL HOURS	COST CALCULATIONS	\$ / HOUR w/OPERATOR	TOTAL \$ / AREA	NOTES / COMMENTS
7	TOPSOIL PLACEMENT ON LEVELED AREAS	FACILITY, DUMP TOPS, LEACH TOPS, TAILINGS POND, 150% GEN. AREA, ROADS.	1789.8	CAT 627E Scraper C.H.-P.P. 120 cu. yd.	25.1	19801	1789.8acre-128ac tails = 661.8 acres 661.8acre@1ft = 661.8A.F. 128acre@2.5ft = 320 A.F. Total = 981.8 A.F. 981.8A.F.*1613.4cuyd/A.F. = 1584037 cu.yd. 1584037cuyd / 80cuyd/hr = 19801 hours 19801 hr / 176hr/mth = 112.5 mth Equip:112.5mth@\$14160/mth = \$1593000 Oper:19801hr @ \$43.20/hr = \$855404 Labor:19801hr @ \$29.20/hr = \$578190	153	3026594	Rental Rate Blue Book page 9-93 Means pg. IX
8	TOPSOIL PLACEMENT ON SLOPES	DIKE FACES, DUMP LEACH FACES, DUMP FACES.	266.7	WABCO 85D Haultruck CAT 992C Loader CAT D8L Dozer	5.72	1526	266.7acres@1ft=266.7A.F. 266.7A.F.*1613.4cuyd/AF= = 430294 cu yd 6 loads/hr*47yd/load = 282 cu yd/hr 430294cuyd/282cuyd/hr = 1526 hours 1526hours / 176hr/mth = 8.67 mths Equip:8.67mth@\$12325/mth = \$106858 Oper:1526hr @ \$42.95/hr = \$65542 Labor:1526hr @ \$25.60/hr = \$39066 Haultruck Total= \$211466 Equip:8.67mth@\$20615/mth = \$178732 Oper:1526hr @ \$90.55/hr = \$138180 Labor:1526hr @ \$29.20/hr = \$44560 Loader Total = \$361472 Equip:8.67mth@\$10805/mth = \$93680 Oper:1526hr @ \$28.50/hr = \$43491 Labor:1526hr @ \$29.20/hr = \$44560 Dozer Total = \$181731	495	754669	Rental Rate Blue Book page 20-15 Means pg. XIV Rental Rate Blue Book page 9-54 Means pg. IX Rental Rate Blue Book page 9-104 Means pg. IX

KENNECOTT UTAH COPPER TAILINGS IMPOUNDMENT

Tailings Characterization for the Prediction of Surface and
Subsurface Drainage Quality
&
Seep and Well Monitoring

Tailings Characterization

1) *Sampling Methods:*

i) Sample site location

a) Map

b) Eastings ; Northings

c) Statistical Design and Considerations
(Random, Grid, etc.)

ii) Sample Interval

a) Composite

b) Depth segregated

c) Underlying Lithologic Sample,
Tailings/Lithologic Interface Sample

iii) Sample collection protocol:

a) Drill rig employed.

b) Cores, chips and shavings

c) Drilling fluids

d) Drill Logs

e) Sampler's name

iv) Sample storage protocol:

a) Sample containers

b) Sample storage temperature and humidity

c) Duration of sample storage prior to
analyses (i.e. Sample collection time and
date - Laboratory analysis time and date)

v) Sample preparation:

- a) Splits - before or after drying, availability of split
- b) Air or Oven Dry - Temperature and duration
- c) Grinding - sieve size (mesh # :U.S.A. Standard{ASTM E-11-87}, Tyler Standard, others).

2) *Procedures for Conducting Static Test:*

- i) Laboratory methods
 - a) Literature Reference - Report divergence from specified procedure.
 - b) Extractions
 - 1) Sequential or Distinct (Esp. sulfur partitioning)
 - 2) Extract normality (NBS- standard solution, laboratory formulation or others)
 - 3) Solid:Extract Ratio
 - 4) Neutralization Potential Digestion - heat sample (duration & temperature); boil sample (duration & temperature); agitation (duration); titration end points
 - 5) Acid Potential- HCl extractable sulfur procedures; HNO₃ extractable sulfur procedure: Sulfur/Iron stoichiometry (titrate or A.A.) Leco Sulfur after HNO₃; Exchangeable acidity (peroxide ,KCl, BaCl-Triethanolamine, others); Active acidity solid:water ratio
 - c) Pyrite Morphology- X-Ray defraction, Elecron micrograph
 - d) Analytical Instrumentation
 - e) Calculations- AP= exchangeable acidity (peroxide ,KCl, BaCl-Triethanolamine, others) + potential acidity (Based on Total-S or Pyritic-S and/or Organic-S {S% * 31.25 or 61.5}+ active acidity
 - f) QA/QC- instrument blanks, splits, spike recovery, matrix interference checks

3) *Procedures for Conducting Kinetic Test:*

- a) Kinetic Test Design - Soxhlet Extractor, B.C. Confirmation Test, Shake Flask, Humidity

Cell, Column Leach

b) Literature Reference - Report divergence from specified procedure.

- i) Dimensions
- ii) Sample preparation prior to column construction.
- iii) Column construction -packing sequence, bulk density
- iv) Initial Solution chemistry
- v) Pore volume(s)
- vi) Recirculate Solution
- vii) Wetting (degree of saturation), drying, and heating duration.
- viii) Drain and inflow specification
- ix) Inoculation w/ T. ferrooxidans

** TRANSMIT CONFIRMATION REPORT **

35-15

Journal No. : 017
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